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Chemistry Matters Department Newsletter

Chemistry

Fall 2018

Chemistry Matters Fall 2018

Otterbein University

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Otterbein University **Fall 2018**

A Word from the Chair

Greetings from the Department of Chemistry. This past year has seen our students and faculty traveling all over the world. A travel course focusing on the chemistry of art conservation took faculty and students to Italy. Five Otterbein students presented their research and the activities of the student chapter at the American Chemical Society National Meeting in New Orleans. I also enjoyed my sabbatical time working in the UK.

In this newsletter you will see many examples of the innovative teaching that has always been a hallmark of our department. You can read about two new INST courses focused on food and drink. Three of our laboratory courses are incorporating the chemistry of biodiesel fuels. Our faculty also continue to contribute to the scholarship of teaching through presentations and peer-reviewed publications.

Congratulations go out to several of our faculty members on their recent promotions! Dr. Robin Grote received tenure and was promoted to Associate Professor; Dr. Brigitte Ramos was promoted to Associate Professor; and Dr. Joan Esson was promoted to Professor. I'd also like to welcome Donna Rhodeback who has been doing an awesome job as our new Administrative Assistant. We also continue to appreciate the behind-the-scenes work of our Stockroom Manager, Jean Szabo, for her attention to detail and excellence in laboratory preparation.

It is my pleasure to work with the faculty and staff in the Department of Chemistry and I hope this newsletter gives you an idea of the quality work that they are doing.

Dr. Dean Johnston

Fall 2017 Sabbatical in Cambridge, UK

Dr. Dean Johnston spent his Fall 2017 sabbatical collaborating with the Cambridge Crystallographic Data Centre (CCDC), publisher of the Cambridge Structural Database (CSD). The CSD is a database of almost one million three-dimensional structures of organic and metal-organic compounds; it is used by chemists for the development of new materials, prediction of crystal forms for pharmaceuticals, and modeling of small-molecule/protein binding, among many other uses. One project looked at patterns of bonding in metal cluster compounds in the database. A second project focused on developing a new method to determine if the data-collection temperatures reported in each structure are consistent with the underlying data. This method could be used in the future by the CCDC to help prevent data entry errors when users submit new structures to the database.

A view of Cambridge University along the River Cam

New Study Abroad Course in Chemistry

In May 2018, Dr. Joan Esson traveled with colleague Dr. Carla Corroto (Sociology) and 13 students from a mix of majors to northern Italy to fulfill either their Senior Year Experience course, *Preservation of Cultural Heritage: From the Macro to the Micro,* or their Integrative Studies Natural Foundations course, *Materials Science and Conservation of Art and Cultural Objects in the Italian Context*.

Students learned basic principles of chemistry by examining their application in art and building conservation and preservation. The group spent three days in Milan, where they spent time in the laboratories at the Politecnico di Milano and with curators at Castello Sforzesco. Students used microscopic methods to look at paint samples taken from Leonardo da Vinci's L'Ultima Cena (the Last Supper) and the porosity of materials from the Duomo di Milano. They also heard talks from head curators about the restoration of and new home for Michelangelo's Rondanini Pieta as well as the restoration of the Sala delle Asse, where they have uncovered a da Vinci fresco behind plastered walls.

The group then spent four days in Venice, where they learned about efforts at Save Venice to restore cultural heritage objects damaged during Venice flooding events, and they took a tour of a Venice lagoon with a researcher from the Italian National Research Council, to learn about hydrological and environmental issues facing Venice. The students also had a free day during which they traveled to nearby cities, including Verona and Padua.

May 2018 Italy travel course participants in Florence

The group then spent five days in Florence, where they visited two restoration laboratories: one at the Cattedrale di Santa Maria del Fiore, more commonly known as the Duomo, and the other at L'Opificio delle Pietre Dure, which is the laboratory associated with the Uffizi Gallery. They had an additional free day to visit a nearby city, including Pisa, Sienna or Lucca.

The group then drove through the Tuscan countryside and learned about the agriculture and chemistry of growing, processing, and tasting olive oil before spending a day at the Vatican, exploring Rome and flying home. What a way to learn how chemistry is applied to the preservation of cultural heritage!

Department Benefits from Outstanding Part-Time Faculty

The Chemistry Department has benefitted greatly from the efforts of a group of talented part time faculty. A big thanks to Dr. Wendy Johnston (General Chemistry I and II Laboratory), Professor Jeffrey Trent (Survey of General Chemistry Lecture and Laboratory, General Chemistry I Laboratory), Professor Matthew Grote (General Chemistry I and Organic Laboratory), and Professor Emily Tansey (Survey of General Chemistry Lecture and Laboratory) for the vital role that they play to ensure that the curricular needs of our students are met. Of special note, Emily Tansey is also teaching a new general education course this semester (BMB 1300), entitled *Biochemistry is a Piece of Cake*. This course uses culinary principles and chemistry to discuss biological molecules. A typical week includes a lecture on Monday and an interactive or laboratory exercise on Wednesday which reinforces the principles discussed on Monday. Finally, on Friday, students prepare a food item that demonstrates the underlying scientific principles covered throughout the week. So far, students have studied and made foods as diverse as ice cream, mayonnaise, and frittatas.

Whisk(e)y is Coming to Otterbein

Dr. John Tansey has been working on a new course with Dr. Michael Levin of the Department of Business, Accounting and Economics. The course, entitled *The Business and Science of Whisk(e)y*, will explore the science and business practices behind how distilled beverages, especially bourbon, are produced and brought to market. This is an interdisciplinary seminar course (IS 3000) which has taken the place of the Integrative Studies DYAD thread. The first seven weeks of the course will discuss how whiskey is produced, from the sourcing of water and grain, different types of yeast, the biochemistry of mashing and fermenting and distilling. An important aspect of bourbon production is the aging step, and this will also be discussed in detail. The course will also discuss how bourbon differs from other whiskeys and how whiskey differs from other distilled beverages. We will conclude the science aspect of the course with a discussion of the health effects of excess alcohol consumption. In the second seven weeks the course will discuss the business plan of a small distillery and compare it to large distilleries. The course will also cover how products are marketed and how market share is established in liquor control versus non-liquor control states. Our departments are very excited about this new course!

Students and Faculty Present at the 255th ACS National Meeting in New Orleans, March 2018

Liz Isaac ’18, John Liu ’18, Meredith Marshall ’21, Carolanne Norris ’18, Manh Tran ’18, Dean Johnston and Joan Esson traveled to New Orleans in March 2018 for the National Meeting of the American Chemical Society. Three students presented the results of their undergraduate research projects conducted together with Dr. Esson. Two students presented about the activities of the Otterbein Student Chapter of the ACS. Dr. Johnston presented a poster about one of his sabbatical projects; and Dr. Esson was busy with meetings representing the Columbus Section of the ACS as a local section Councilor.

Student Presentations at the National ACS Meeting:

- Surface-enhanced Raman spectroscopy (SERS) analysis of western African artifacts. M.C. Marshall, J.M. Esson
- Characterization of a paper-based analytical device for low molecular weight and unfractionated heparin. C.E. Norris, J.M. Esson
- Chemical analysis of artistic and cultural heritage objects from western Africa. M.H. Tran, J.M. Esson
- Otterbein Student Chapter: Moving involvement off campus. E. Isaac, J. Liu, J.M. Esson, R. Grote

Congratulations to our Endowed Scholarship Recipients in this newsletter including Meredith Marshall ’21 (Victor G. and Eileen Ritter Endowed Scholar) and Eileen Connon (Virgil O. & Charlotte H. Hinton Scholar). Thank you to all the donors who help our students have incredible experiences at Otterbein!

Exploring Biodiesel Chemistry in Multiple Lab Courses

Faculty members Dr. Robin Grote, Dr. Carrigan Hayes, and Dr. Brigitte Ramos have developed an innovative interdisciplinary experiment exploring biodiesel chemistry over the past few years. In July 2018, Carrie presented a talk on this project at the 2018 Biennial Conference on Chemistry Education, held on the campus of the University of Notre Dame.

The small diesel engine in which the biofuels are tested.

Via this laboratory experience, students in Organic Chemistry Lab, Physical Chemistry Lab, and Engineering Chemistry Lab explore various aspects of fuel standardization, learning why organizations such as the National Institute of Standards and Technology (NIST) and the American Society for Testing and Materials (ASTM) play an important role in fuel production and consumption.

For instance, in Physical Chemistry Lab, students are given the option of a variety of starting oils and synthesis protocols with which to carry out a transesterification reaction and thus synthesize a methyl ester that can be classified as biodiesel. These biodiesel samples are then characterized in terms of calorimetry, density, pH, and other properties. Class data are compiled and students have a chance to see the variety of results obtained for these samples, observing on a small scale the necessity for standardized protocols and reference materials provided by such agencies as NIST and ASTM.

CHEM 1710 students preparing to test their biofuels under the guidance of Jean-Marie Piednoir of the Westerville Aeronautics Association.

In Engineering Chemistry Lab, students use both pure vegetable oil and waste vegetable oil from the Otterbein Campus Center as their starting materials for a similar synthesis reaction, ultimately preparing and testing the properties of two biodiesel samples via density, viscosity, and energy content. Students use protocols based on ASTM methodologies and deliberately explore the need for standardization techniques. Their fuels are ultimately tested in a small diesel engine, through a collaboration with the Westerville Aeronautics Association.

These experimental modules build on student research completed by Mallory Gasbarre (Class of 2017) and Maithri Kora (Wellington School, Class of 2018).

Chemistry Professor Takes to the Skies

Dr. Joan Esson is a member of the skydiving team “Shapeshifters,” who won the gold medal at the United States Parachute Association National Championship in Ottawa, IL September 13, 2018. This marks Dr. Esson’s 20th year of jumping.

Faculty Updates: Esson

Dr. Joan Esson has been busy over the past year working with and developing new opportunities for students, as well as conducting research related to the STEM education. Joan had three papers published in 2018. A laboratory activity at the interface of chemistry and art was published in the *Journal of Chemical Education* with colleague Carrie Hayes and student Rachel Scott as co-authors; a nationwide study of STEM teaching was published in the prestigious journal *Science*; and a study of student motivation across introductory STEM courses appeared in the *International Journal of Science Education*. Additionally, three of Joan's research students presented at the 255th ACS meeting in New Orleans. This included interdisciplinary work with Otterbein's Frank Museum of Art, investigating the materials used on objects from their Western African art collection, as well as advances towards new methods to measure dyes and paper analytical devices for clinical analytes such as the anticoagulant heparin. Joan also gave three presentations at a variety of national meetings to disseminate information from the nationwide study of STEM teaching; discuss classroom observations protocols for use in STEM; and describe her new study abroad course to Italy. Finally, Joan received a Faculty Scholar Development Committee International Enrichment Grant to travel to England with colleagues Dr. Anna Young (Biology) and Dr. Steffanie Burk (Equine) to explore and develop new study abroad opportunities for students. While in England, they also conducted colorimetric studies on a historic collection of *Poicephalus* parrots at the Natural History Museum in Tring to gather data that may support species delimitation for the Cape parrot.

Picture taken at the Natural History Museum in Tring. Pictured left to right: Steffanie Burk (Equine), Anna Young (Biology), Eileen Connon (Biology '19), and Joan Esson.

Class of 2018 Updates

In Spring 2018, four outstanding chemistry students graduated from Otterbein University: Elizabeth Isaac, John Liu, Carolanne Norris, and Manh Tran. In the start of the fall semester, we have been pleased to hear updates from our newest alumni.

Elizabeth (Liz) Isaac is currently in the midst of her first semester at the University of Delaware and will choose a research group within the next few weeks. She spent the summer of 2018 at Lubrizol, working on copper corrosion inhibition, oil refinery sulfiding agents, and establishing a chemical inventory for over 1,500 chemicals.

While at Otterbein, Liz was the president of the student chapter of the American Chemical Society; she completed research with both Dr. Robin Grote and Dr. Joan Esson; and she was a teaching assistant and tutor.

Carolanne Norris '18

Carolanne Norris is completing her first term at the University of Arizona, taking coursework in biochemistry and analytical chemistry, along with multiple research seminars. She also is working as a teaching assistant in General Chemistry lecture and teaching multiple labs. "I am very excited about all the possibilities for the future here, even though I know I am going to be super busy," Carolanne recently reported. (Continued on Page 6)

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Are you interested in keeping up-to-date more regularly with Chemistry Department activities and people, and in networking with other Otterbein alumni? Then join the Otterbein Chemistry Department LinkedIn page and/or Facebook page!

We also invite alumni to interact with current students. If you are an alum who wants to give a technical talk, participate in a panel about careers, or is willing to mentor a current student, please reach out to Joan Esson (jesson@otterbein.edu). We want to especially thank Dr. Erica Hlavin Bell '05 for recently participating in a virtual panel about STEM graduate programs with our current students!

Class of 2018 Updates (cont'd)

While at Otterbein, Carolanne wrote and defended her Honors Thesis under the guidance of Dr. Joan Esson, exploring the characterization of a paper-based analytical device for low molecular weight and unfractionated heparin. She also worked as a teaching assistant and tutor for a wide array of chemistry labs and lectures.

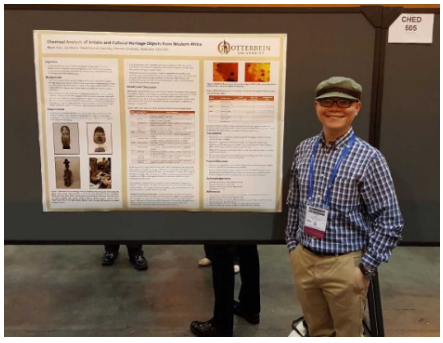
Arizona scenery. Photograph by Carolanne Norris '18

Manh Tran is currently completing some preliminary engineering coursework at Columbus State Community College, with a goal of ultimately obtaining a graduate degree in chemical engineering.

While at Otterbein, Manh pursued a strong interest in art, along with his chemistry classwork and research. He completed several outstanding ceramics pieces and drawings, some of which are pictured in this newsletter. Additionally, Manh was able to combine his interests in chemistry and art via a research project completed with Dr. Joan Esson at Otterbein's own Frank Museum of Art, examining pieces from the Western Africa collection using X-ray fluorescence, widefield fluorescence microscopy, and Raman spectroscopy.

Ceramic piece by Manh Tran '18

John Liu is in the process of applying to medical school. While at Otterbein, John conducted research together with Dr. Johnston investigating the preparation and structural characterization of acetonitrile-substituted molybdenum halide cluster compounds. John was also very active with the student chapter of the American Chemical Society.



Manh Tran '18 presenting his research poster at the Spring 2018 national conference of the American Chemical Society.